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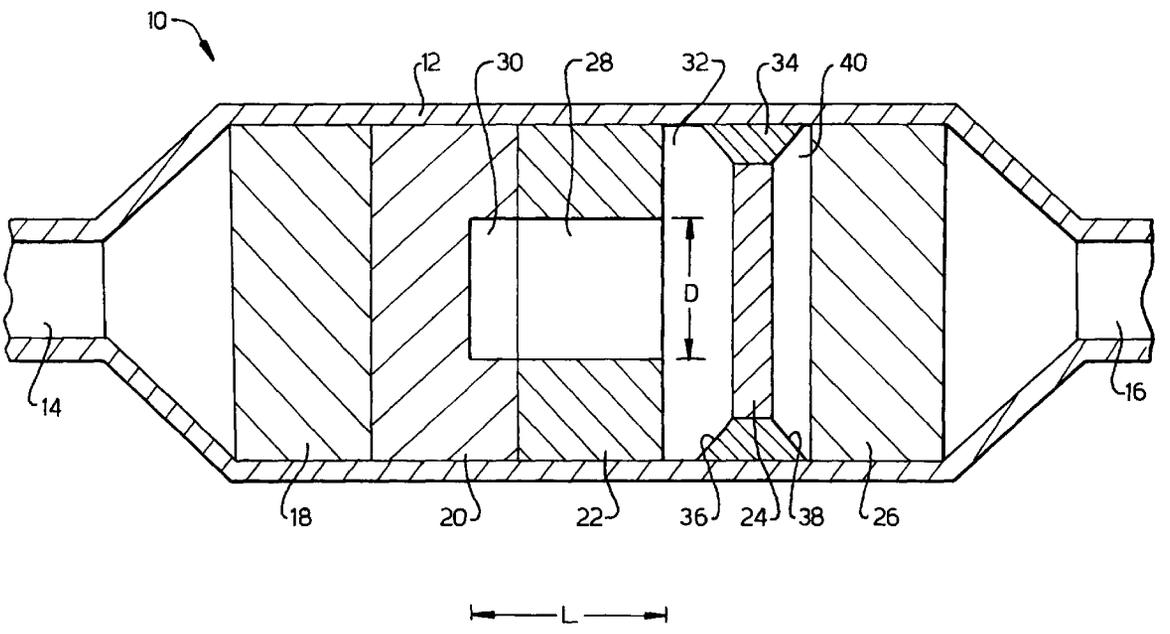
(54) Catalytic converter for vehicle exhaust

(57) A catalytic converter (10) for an exhaust system of a motor vehicle comprising a housing (12) having an inlet (14) and an outlet (16); a first brick (18) positioned inside the housing adjacent the inlet for initiating catalytic light-off functions of exhaust gases flowing through the first brick; a second brick (20) positioned adjacent the first brick downstream of the inlet for three way conversion of exhaust gases flowing through the second brick; a third brick (22) positioned adjacent the second brick downstream of the inlet for hydrocarbon adsorption and oxidation of exhaust gases flowing through the third brick; and a fourth brick (24) positioned adjacent and spaced from the third brick downstream of the inlet for light-off of exhaust gases flowing through the fourth brick; wherein the third brick is substantially annular with a through bore (28) extending axially therethrough; and wherein the second brick has a closed bore (30) extending axially and opening into the through bore of the third brick. Reduces light-up time for the converter.

Fig.1.



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Description

Technical Field

[0001] The present invention relates to a catalytic converter for the exhaust system of a motor vehicle.

Background of the Invention

[0002] The use of a catalytic converter in the exhaust system of motor vehicle is well known. The catalytic converter acts on the exhaust gases leaving the engine of the vehicle to convert carbon monoxide, the oxides of nitrogen, and hydrocarbons in the exhaust gases. A typical catalytic converter consists of a number of bricks (coated substrates) through which the exhaust gases can pass. In order to work efficiently, these bricks must be at a temperature which is above the light-off temperature - the temperature above which conversion is most effectively achieved. The temperature of the exhaust gases is used to maintain the temperature of these bricks above the light-off temperature (the threshold temperature above which the catalyst is active). However, when the engine is started from cold, there is an initial period (the cold phase or light off time) when the catalytic converter is cold and inactive but exhaust gases are passing through the converter. During this initial period, the converter is not working in an efficient manner.

Summary of the Invention

[0003] It is an object of the present invention to provide a catalytic converter with a reduced inactive period after a cold start.

[0004] A catalytic converter in accordance with the present invention for an exhaust system of a motor vehicle comprises a housing having an inlet and an outlet; a first brick positioned inside the housing adjacent the inlet for initiating catalytic light-off functions of exhaust gases flowing through the first brick; a second brick positioned adjacent the first brick downstream of the inlet for three way conversion of exhaust gases flowing through the second brick; a third brick positioned adjacent the second brick downstream of the inlet for hydrocarbon adsorption and oxidation of exhaust gases flowing through the third brick; and a fourth brick positioned adjacent and spaced from the third brick downstream of the inlet for light-off of exhaust gases flowing through the fourth brick; wherein the third brick is substantially annular with a through bore extending axially therethrough; and wherein the second brick has a closed bore extending axially and opening into the through bore of the third brick.

[0005] The catalytic converter of the present invention is such that the fourth brick is heated by exhaust gases passing through the aligned bores to its light-off temperature before the third brick reaches its threshold (desorption) temperature. Such an arrangement reduces the inactive period for the converter when compared to previously known arrangements with minimal increase in cost or complexity. In a preferred arrangement, the fourth brick is a coated metallic foam which enhances gas mixing in the brick and improves radial heat conduction.

Brief Description of the Drawings

[0006] The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

[0007] Figure 1 is a cross-sectional view of a catalytic converter in accordance with the present invention.

Description of the Preferred Embodiment

[0008] Referring to the drawing, the catalytic converter 10 in accordance with the present invention is for use in an exhaust system (not shown) connected to an engine of a motor vehicle. The converter 10 comprises a housing 12 having an inlet 14 and an outlet 16. The inlet 14 receives exhaust gases from the engine, and the outlet 16 directs converted exhaust gases towards the outlet of the exhaust system, so gas flow through the converter 10 is from the inlet to the outlet. The inlet 14 and outlet 16 may be substantially aligned. Positioned within the housing 12 are first, second, third, fourth and fifth bricks 18,20,22,24,26, respectively, with the first brick adjacent the inlet 14 and the fifth brick adjacent the outlet 16. The second brick 20 is positioned between, and in contact with, the first and third bricks 18,22, and the fourth brick 24 is positioned between, and spaced from, the third and fifth bricks 22,26. The bricks 18-26, which are described in more detail below, allow exhaust gases to flow through the converter 10 from the inlet 14 to the outlet 16.

[0009] The first brick 18 is a coated substrate which has the primary function of initiating the catalytic conversion of the gases when the system starts from cold (ambient) conditions. The second brick 20 is a coated substrate which has the primary function of providing three way catalytic conversion (CO to CO_2, NO to N_2O and HC to H_2O and CO_2) complementary to the first brick 18 especially after the light-off phase. The second brick 20 is meant to achieve maximum conversion in the whole engine operating range when the converter 10 is heated to its normal operating temperature. The third brick 22 is a coated substrate which has the primary functions of hydrocarbon adsorption and hydrocarbon oxidation. The fourth brick 24 is a coated foam (preferably metallic, such as stainless steel, or a material having similar characteristics) which has the primary function of rapid light-off, and rapid thermal response. The fifth brick 26 (which is optional) is a coated substrate which has the primary function of three way conversion. The coating material(s) on the bricks 18-26, and the ma-

terial(s) for the substrates for the first, second, third and fifth bricks and the foam for the fourth brick, can be any known or suitable material(s) for fulfilling the primary functions mentioned above.

[0010] The axial lengths of the first and second bricks 18,20 are predetermined to maintain the third brick 22 below its desorption temperature until after the temperature of the first brick 18 has risen above its light-off temperature.

[0011] The third brick 22 is substantially annular and has a through bore 28 which opens into a closed bore 30 formed in the second brick 20. The bores 28,30 extend axially along the longitudinal axis of the converter 10. The through bore 28 also opens into the space 32 between the third brick 22 and the fourth brick 24. The fourth brick 24 has a reduced outer diameter compared to the other bricks 18-22,26 and is mounted on an annular support member 34 having an angled upstream face 36 and an angled downstream face 38. The angled faces 36,38 are provided to reduce flow restrictions.

[0012] In use, exhaust gases which flow through the first brick 18 and the second brick 20 into the bores 28,30 arrive at the fourth brick 24 with a higher temperature than the exhaust gases which flow through the first, second and third bricks 18-22 before arriving at the fourth brick. The exhaust gases which flow through the bores 28,30 induce a rate of temperature rise in the fourth brick 24 whilst the third brick 22 is being heated at a slower rate by the exhaust gases flowing through the second and third bricks 20,22. The exhaust gases flowing through the second and third bricks 20,22 are cooled down by eat transfer to the substrate. The temperature differential between these two streams of exhaust gases is dependent on the diameter D and axial length L of the bores 28,30. This has the effect of delaying the time taken for the third brick 22 to reach its desorption temperature (the threshold temperature above which the third brick releases stored hydrocarbons) until after the fourth brick 24 has been heated above its light-off temperature. As a consequence, the hydrocarbons subsequently released by the third brick 22 are converted by the fourth brick 24. The values for D and L are specific to the exhaust system to which the converter 10 is attached and are determined accordingly to ensure that the fourth brick 24 is heated to its light-off temperature before the third brick 22 reaches its desorption temperature.

[0013] The reduced passage of the fourth brick 24 forces the mixing of the exhaust gases flowing out of the third brick 22 and the bores 28,30 in the space 32. The metallic foam of the fourth brick 24 provides an open pore structure which acts as a thermally responsive element within the converter 10. Such an element provides exhaust gas flow mixing because of the random structure, and radial heat conduction. The outer diameter of the fourth brick 24 is reduced to concentrate heating from the exhaust gases flowing out of the bores 28,30 on a smaller surface area. The angled downstream face 38 of the support member 34 allows the converted exhaust gases flowing out of the fourth brick 24 to pass through the space 40 between the fourth and fifth bricks 24,26 to reach the full cross-sectional area of the fifth brick.

Claims

1. A catalytic converter (10) for an exhaust system of a motor vehicle comprising a housing (12) having an inlet (14) and an outlet (16); a first brick (18) positioned inside the housing adjacent the inlet for initiating catalytic light-off functions of exhaust gases flowing through the first brick; a second brick (20) positioned adjacent the first brick downstream of the inlet for three way conversion of exhaust gases flowing through the second brick; a third brick (22) positioned adjacent the second brick downstream of the inlet for hydrocarbon adsorption and oxidation of exhaust gases flowing through the third brick; and a fourth brick (24) positioned adjacent and spaced from the third brick downstream of the inlet for light-off of exhaust gases flowing through the fourth brick; wherein the third brick is substantially annular with a through bore (28) extending axially therethrough; and wherein the second brick has a closed bore (30) extending axially and opening into the through bore of the third brick.

2. A catalytic converter as claimed in Claim 1, wherein the fourth brick (24) is mounted on an annular support member (34) and has a reduced diameter compared to the outer diameter of the third brick (22).

3. A catalytic converter as claimed in Claim 2, wherein the annular support member (34) has an angled upstream face (36) in the space (32) between the third and fourth bricks (22,24).

4. A catalytic converter as claimed in any one of Claims 1 to 3, wherein the fourth brick (24) comprises a coated metallic or equivalent foam.

5. A catalytic converter as claimed in any one of Claims 1 to 4, further comprising a fifth brick (26) positioned adjacent and spaced from the fourth brick (24) downstream of the inlet (14) for three way conversion of exhaust gases flowing through the fifth brick.

6. A catalytic converter as claimed in Claim 5, in which the fourth brick (24) is mounted on an annular support member (34), wherein the annular support member has an angled downstream face (38) in the space (40) between the fourth and fifth bricks (24,26).

Fig. 1.